Two New Species and a New Combination in South American Eriocaulaceae

Nancy Hensold

Department of Botany, The Field Museum of Natural History, 1400 South Lakeshore Drive, Chicago, Illinois 60605-2496, U.S.A. nhensold@fieldmuseum.org

ABSTRACT. Described as new are *Eriocaulon huanchacanum*, a caulescent rheophyte endemic to Bolivia with capillary leaves and non-aerenchymatous roots, and *Syngonanthus dichroanthus* of Brazil and Bolivia, a rosulate annual with filiform leaves and staminate and pistillate flowers of contrasting colors. *Syngonanthus latifolius* of Mato Grosso, Brazil, based on *S. gracilis* var. *latifolius* Moldenke, is dimorphic both for flower color and size, and is here raised to species rank due to these previously undescribed characters.

Key words: Bolivia, Brazil, Eriocaulaceae, *Eriocaulon*, rheophyte, South America, *Syngonanthus*.

The Eriocaulaceae are a herbaceous monocotyledonous family of 10 genera and about 1200 species (Stützel, 1998), which typically occur on wet, acidic, nutrient-poor soils. Their center of diversity is in mountainous areas of the Precambrian shields in Venezuela and Minas Gerais, Brazil, but the Amazon Basin and Central Plateau of Brazil and Bolivia also support interesting endemics, especially in the genera *Eriocaulon* and *Syngonanthus*.

Eriocaulon is a predominantly aquatic or amphibious genus, with most species rosulate and distinguished by subtle characters. The rheophyte *Eriocaulon huanchacanum*, here described from the isolated Serranía Huanchaca in Bolivia, is remarkably distinct due to its long stem, capillary leaves with broad, imbricate bases, and unusual root morphology.

The two closely related annual species of *Syngonanthus* here treated are exceptional in their staminate and pistillate flowers of contrasting colors. Both are found in wet valleys adjoining cerrado and are rarely collected.

Eriocaulon huanchacanum Hensold, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Velasco, Parque Nacional Noel Kempff M., Campamento Huanchaca, a 3.35 km en línea recta desde el campamento base hacia el Río Pauserna, 13°56′01″S, 60°49′39″W, 650 m, 22 May 1994 (fl), *L. Arroyo, Killeen, Mostacedo & Wellens 741* (holotype, MO; isotypes, F, NY, USZ not seen). Figure 1.

Herba aquatica caulescens; radices durae tortuosae substrato per pilos arcte adhaerentes; caules 10–25 cm longi decumbentes ubique foliosi, ad nodos radicantes. Folia capillacea atroviridia uninervia, 9–16 cm longa, 0.3 mm lata, vaginis abrupte ampliatis imbricatis, caulem obtegentibus. Inflorescentia solitaria terminalis; pedunculi 18–22 cm longi, 0.7–0.8 mm diametro; capitula 5 mm diametro; bracteae involucrales nigrae glabrae obovatae apice rotundatae. Flores trimeri; sepala nigra ca. 1.4–1.8 mm longa, albociliata, eis florum staminatorum liberis vel in spatha connatis; petala subaequalia; antherae nigrae.

Submerged caulescent aquatics of flowing water; roots brown, tortuose, corky in texture, non-compressible, not diaphragmed, not aerenchymatous, the middle cortex undifferentiated, ca. 0.3–0.6 mm diam., sparingly branched, adventitious at intervals along the decumbent base of the stem, with localized segments densely pubescent and adhering tightly to the substrate, otherwise glabrous; *stems* ca. 10–25 cm long, ca. 2 mm diam., decumbent and often branched below, ascending and uniformly leafy above, the villous pubescence concealed by the persistent leaf sheaths. *Leaves* capillaceous, subterete in cross section, ca. 9–16 cm long, 0.3 mm wide, glabrous, blackish and brittle when dry, one-veined, weakly fenestrate (with transverse diaphragms of chlorenchyma) only at the base, otherwise the chlorenchyma confined to a single bifacial palisade layer; leaf sheaths ca. 6–7 mm long, dark green along the midvein with pale margins, ranging from 1 mm wide and gradually narrowed to the blade (*Ritter 4408*) to up to 3 mm wide and abruptly constricted to the blade, the upper margin truncate to asymmetrically auriculate and sparingly short-ciliate, the margins of adjoining sheaths overlapping, chartaceous, completely enclosing the stem. *Inflorescences* solitary and terminal, suberect, emergent; peduncle sheaths 4–6 cm long, 1.6–1.7 mm wide, glabrous, lax, split down one side, white-costate, the costae broader toward base, the lamina obtuse to subtruncate, erose to dentate or lacerate; *peduncles* 18–22 cm long, 0.7–0.8 mm diam., glabrous, ca. 6-costate, with white costae and green

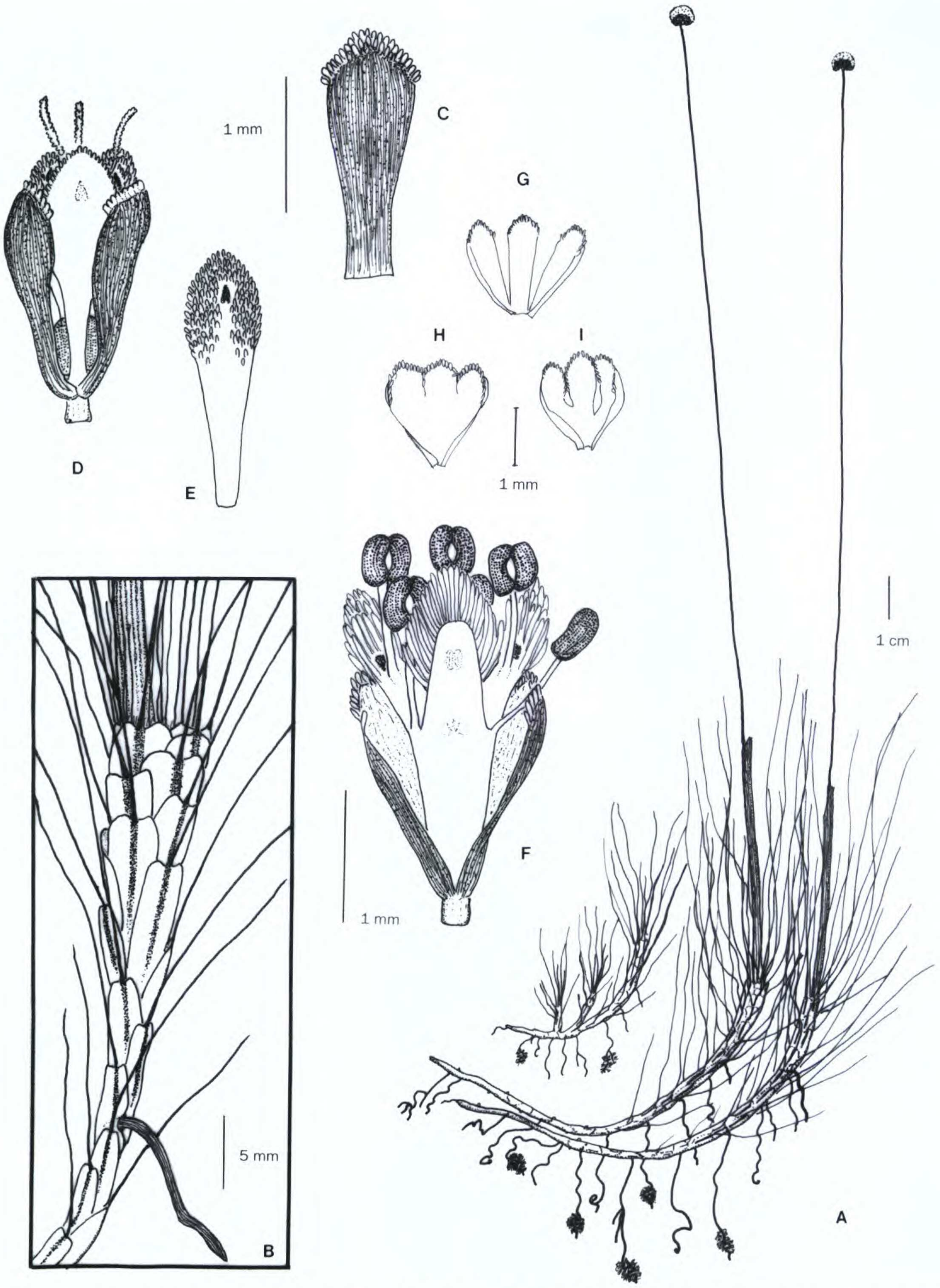

Figure 1. *Eriocaulon huanchacanum* Hensold. —A. Habit. —B. Detail of flowering stem apex showing imbricate leaf bases. —C. Receptacular bract. —D. Pistillate flower. —E. Petal of pistillate flower. —F. Staminate flower. —G–I. Variation in sepal fusion of staminate flower. Vouchers: A–E, H *Arroyo et al. 741*; F, I *Ritter et al. 4408*; G *Killeen et al. 7523*.

intercostae; *capitula* hemispheric, ca. 5 mm diam., the involucral bracts blackish brown, obovate, rounded at the apex, ca. 1.5 mm long, 0.9–1.0 mm wide, glabrous, thin and papery, lacerating with expansion of the head; involucre about equaling the capitulum; receptacular bracts blackish, broadly linear-spatulate, apiculate-rounded at apex, ca. 1.8 × 0.5–0.7 mm, equaling the flowers, tufted at upper margins and abaxially with milky white clavate trichomes ca. 0.15 mm long. *Staminate and pistillate flowers* 3-merous, the relative numbers of the two types varying between plants; *staminate flowers*: *sepals* 1.6–1.8 × 0.5–0.8 mm, blackened distally, broadly oblanceolate, the laterals slightly falcate-curved and cucullate, nearly free, or spathaceously fused to the inner (adaxial) sepal for up to ¾ of their length, the degree of fusion varying even within individuals, the upper margins bearded with white clavate trichomes; *petals* borne on a fleshy obconic stipe 1.2–1.4 mm long, obtuse-triangular, subequal, 0.65–1.1 × 0.4–0.75 mm at middle, exserted from calyx, bearing a thick tuft of white clavate trichomes ca. 0.4–0.5 mm long at the upper margin and submarginally within in the distal half, conspicuously black-glandular adaxially just below the apex; the gland squarish or bilobed and up to 0.2 mm diam.; stamens 6, the outer whorl with filaments free, ca. 1 mm long, the inner whorl with filaments ca. 1.25–1.4 mm long, the lower portion adnate to the petals below the gland; anthers exserted, black, 0.4–0.45 mm long; pollen black; *pistillate flowers*: *sepals* free, oblong to oblanceolate, rounded at apex, the laterals slightly cucullate-keeled, 1.4–1.5 × 0.5–0.75 mm, blackish, pubescence as in staminate flowers; *petals* free, oblanceolate-spatulate, narrowed at base, 1.8–1.9 × 0.5–0.6 mm, exserted, the black subapical gland prominent and conical, densely pubescent with short white clavate trichomes at upper margin and adaxially in the upper third, surrounding the gland; ovary short-stipitate (the stipe sometimes occurring between the petals and sepals), the style branches ca. 1.4 mm long, well-exserted at anthesis. Seeds not seen.

Phenology. Collected in flower from May to July.

Ecology and distribution. Known only from the Serranía Huanchaca (Capuruch) in northern Santa Cruz, Bolivia, near the border with Mato Grosso, Brazil, at 230–650 m. It occurs as a submerged aquatic with emergent capitula, in rapidly flowing water, probably limited to permanent watercourses.

Eriocaulon huanchacanum is a highly distinct species characterized by its submerged rheophytic habit, capillaceous subterete single-veined leaves fenestrate only very weakly at the base, scale-like imbricate leaf bases, and a long slender decumbent stem anchored along its length by tortuose brown roots.

Roots of this type have not previously been reported in *Eriocaulon*. Spongy white aerenchymatous roots, usually lacking root hairs, and with a unique, visibly diaphragmed structure (i.e., transverse diaphragms of stellate parenchyma alternating with a radially arranged, lamelliform aerenchyma) are virtually diagnostic for the genus and seem to correlate with tolerance for waterlogging (Stützel, 1988). However, the cells of the middle cortex of the roots of *E. huanchacanum* are rigid, undifferentiated, and rounded in cross section, as shown by hand sections of the type. The roots presumably have a mechanical rather than absorptive function, facilitated by the dense growth of root hairs on lower sections of some roots, bound tightly to clumps of soil particles (mostly sand).

Although this is the first definite record of non-aerenchymatous roots in *Eriocaulon*, anatomically similar roots were found on submerged rhizomes of *E. spruceanum* Körnicke (vel aff.; *Killeen et al. 7527* [F]), a broad-leaved rosulate rheophyte collected together with *E. huanchacanum* in the Rio Pausernas.

This is consistent with the pattern seen in two other rheophytic Eriocaulaceae of rapidly flowing water, *Leiothrix fluitans* (Körnicke) Ruhland, of Minas Gerais, Brazil, and *Rondonanthus capillaceus* (Körnicke) Hensold & Giulietti, of the Guayana Highland. Both lack root aerenchyma, in contrast to the terrestrial members of their genera (Tomlinson, 1969, for *Paepalanthus capillaceus*; Giulietti, 1984). In both species, clusters of root hairs bound to sand grains can be observed. Both also have capillary leaves and elongate branched stems with roots adventitious along their length, but the stems are much stouter and more densely leafy than those of *Eriocaulon huanchacanum*.

The specialized morphology of *Eriocaulon huanchacanum* implies that it is obligately aquatic, probably in sandy-bottomed black water rivers with water all year. Its narrow habitat requirements and endemism suggest a vulnerable conservation status. The Serranía de Huanchaca, where *E. huanchacanum* is endemic, represents an isolated remnant of the Precambrian Brazilian shield, supporting a mixture of cerrado and Amazonian forest on infertile soils derived from granite and gneiss (Killeen et al., 1993).

The Rio Pausernas, from which two of the three collections were made, is also a collection site for

two other rarely collected rheophytes, *E. spruceanum* and *Paepalanthus saxicola* Körnicke.

The closest affinities of the species are not known. Its unspecialized flowers are typical for *Eriocaulon* subg. *Trimeranthus* Nakai, to which most other South American species belong. Although Asian *Eriocaulon* have been the subject of exhaustive taxonomic treatment and sectional classification (reviewed by Zhang, 1999), no such analysis is available for the New World species. Ruhland (1903) refused to attempt it due to the difficulty in discerning taxonomically useful characters, but even he employed characters of sepal fusion and symmetry in his key, which, as in *E. huanchacanum*, can vary within species and even capitula (Fig. 1G–I).

Superficially, *Eriocaulon huanchacanum* resembles the common circumtropical aquatic species *E. setaceum* L. (including *E. melanocephalum* Kunth, fide Zhang, 1999), due to the blackish capillary leaves. However, *E. setaceum* has fascicled spongy roots, leaves conspicuously fenestrate and not at all ampliate or imbricate at base, the stem swollen and nearly hollow, and numerous inflorescences borne in a terminal umbellate cluster, rather than singly. In Bolivia it favors seasonally inundated habitats.

The only other caulescent species of *Eriocaulon* with leaves less than one millimeter wide are *E. aquatile* Körnicke, endemic to Minas Gerais, Brazil (Giulietti, 1978), and *E. madagascariense* Moldenke, endemic to Madagascar. Both have pale green flat fenestrate membranous leaves with no differentiated basal sheath.

Paratypes. BOLIVIA. **Santa Cruz:** Prov. Velasco, Parque Nacional Noel Kempff M., Campamento Huanchaca I, Rio Pausernas, 26 July 1995 (fl), *T. Killeen et al. 7523* (F, MO, NY, USZ not seen); Prov. Velasco, above guard station at Las Torres, 29 June 1998 (fl), *N. Ritter et al. 4408* (F, NHA not seen).

Syngonanthus dichroanthus Hensold, sp. nov. TYPE: Brazil. Goiás: Veredão do Relâmpago, duas léguas de Carolina, 28 May 1950 (fl), *J. M. Pires & G. A. Black 2365 p.p.* (holotype, NY; isotype, P). Figure 2A–F.

Herba annua rosulata. Folia capillacea uninervia 0.7–2.0 cm longa, 0.1–0.2 mm lata, fere glabri. Inflorescentiae 1–2; pedunculi 7–13 cm longi; capitula 2.5–3.5 mm diametro; bracteae involucrales hyalinae pallidae glabrae, capitulum excedentes. Bracteae florales nullae; flores staminati: sepala cuprea glabra ca. 0.8–1.1 mm longa; flores pistillati: sepala albida glabra 1.0–1.2 mm longa; corolla glabrata; appendices styli inconspicuae.

Plants delicate rosulate annuals; roots fine, white, spongy (aerenchymatous), branched, about as wide as the leaves. *Leaves* filiform, weak and membranous, ca. 0.7–2.0 cm long, 0.1–0.2 mm wide, flat with a single sunken vein buttressed to both surfaces, very obscurely fenestrate, glabrate or with a few scattered appressed hairs. *Inflorescences* mostly 1 or 2 per plant; peduncle sheaths 16–22 × 0.3–0.6 mm, the lamina 2.5–3.5 mm long, acute; pubescent with scattered malpighian hairs or glabrous, sometimes conspicuously pale-costate especially toward the base; *peduncles* 7–13 cm long, 0.15–0.3 mm wide, 3-costate, with green intercostae and stramineous costae, the costae broadening and intercostae becoming narrow furrows toward the base; pubescent at the apex with a collar of appressed hairs, also ± pubescent with malpighian hairs on the intercostae, and sometimes with a few erect gland-tipped hairs near the apex when young, glabrate below; *capitula* 2.5–3.5 mm wide, fusiform in bud, depressed-hemispheric at maturity; involucral bracts grading from oblong-obtuse below to lanceolate-acute above, the larger 1.3–1.7 × 0.4–0.6 mm, surpassing the capitulum by 0.6–0.7 mm; hyaline-stramineous, with a faint brown tinge, glabrous; receptacle densely villous, the trichomes pure white and nearly equaling the flowers; receptacular bracts absent. *Flowers* 3-merous, short-pedicellate, the staminate and pistillate about equally mixed, of sharply contrasting colors; *staminate flowers*: *sepals* deep coppery brown, lustrous, glabrous, fused briefly at base, obovate, broadly rounded and usually erose at apex, ca. 0.8–1.1 mm long, the laterals ca. 0.4–0.5 mm wide, slightly falcate-curved and cucullate, the inner (adaxial) sepal flat and slightly smaller; *corolla* tubular, borne on a fine stipe ca. 0.5 × 0.1 mm; the corolla itself ca. 0.5 mm long, the lobes involute after anthesis; anthers white, ca. 0.15 mm long; pistillodes inconspicuous, threadlike; *pistillate flowers*: *sepals* lance-ovate to ovate, navicular, acute, 1.0–1.2 × 0.35–0.5 mm, white, or slightly copper-tinged at the tips, glabrous; *petals* membranous, white, linear-spatulate, shorter than the sepals, ca. 0.9 × 0.15 mm, with a few long scattered cilia in juvenile state, glabrous at anthesis; style ca. 0.5 mm, the style branches shorter, stylar appendages small and threadlike or apparently lacking. Mature seeds not seen.

Ecology and distribution. Known from three disjunct Amazonian localities, in northern Goiás, Brazil, near the border with Maranhão (near Carolina), near Manaus, Brazil, and in Bolivia along the Río Iténez (Río Guaporé) bordering Rondônia, Brazil. It occurs in wet and seasonally inundated cam-

po below 500 m, and is possibly amphibious. (See *S. latifolius* for further discussion of habitat.)

The holotype of *Syngonanthus dichroanthus* at NY is a mixed sheet including an unidentified rosulate species of *Eriocaulon* of about the same stature. The isotype sheet at P is a mixture with the same *Eriocaulon* as well as with *Eleocharis minima* Kunth (Cyperaceae). Both sheets were distributed as *S. simplex* (Miquel) Ruhland.

This inconspicuous mud-dwelling species is known so far only from mixed collections with other diminutive species. Its relatives include several other small rosulate annuals with pale glabrous capitula, including *Syngonanthus gracilis* (Bongard) Ruhland, *S. biformis* (N. E. Brown) Gleason, *S. simplex* (Miquel) Ruhland, and *S. latifolius* (Moldenke) Hensold. *Syngonanthus dichroanthus* is distinguished from these in part by its delicate habit, membranous threadlike leaves, and involucral bracts exceeding the capitulum. From the closely sympatric and common taxon *S. gracilis* var. *aureus* Ruhland, it can usually be distinguished by the lack of glandular hairs on the peduncle sheaths. However, its most striking feature is the strong contrast between the copper-colored staminate flowers and the white pistillate flowers, an unusual characteristic shared only with *S. latifolius*.

Strong differentiation in the color of the staminate and pistillate flowers occurs to my knowledge in only a few divergent species of *Syngonanthus*. These include the dimorphic-stemmed aquatic *S. spongiosus* Hensold, with staminate flowers deep yellow-brown, and the rosette species *S. angolensis* Hess of Africa and *S. goyazensis* (Körnicke) Ruhland of Brazil, in both of which the staminate calyces are deeply pigmented only below the lobes.

The specimen from Manaus (*Lützelburg 21962 p.p.*) lacks staminate flowers, which makes positive identification difficult, but is provisionally placed here due to the glabrous flowers, involucral bracts glabrous and surpassing the capitulum (which distinguish it from *Syngonanthus biformis* and *S. simplex*), the membranous leaves, and lack of glandular hairs.

Paratype. BOLIVIA. **Santa Cruz:** Prov. Velasco, Estación Flor de Oro, margen del Río Iténez (Guaporé), frontera con Rondônia, ca. 20 km N del Serranía de Huanchaca, ca. 85 km E del Río Paragua, 15 May 1991 (fl), *M. Peña et al. 62 p.p.* (F, mixed collection with *Syngonanthus gracilis* var. *aureus* Ruhland).

Additional specimen examined. BRAZIL. **Amazonas:** Manaus, Villa Municipal, 28 Aug. 1916 (♀), *Lützelburg 21962 p.p.* (LL = fragment ex NY, mixed collection with *Utricularia* and sterile graminoid, probably Cyperaceae).

Syngonanthus latifolius (Moldenke) Hensold, comb. nov. Basionym: *Syngonanthus gracilis* var. *latifolius* Moldenke, Phytologia 21: 418. 1971. TYPE: Brazil. Mato Grosso: Serra do Roncador, gallery margin, ca. 86 km N of Xavantina, 550 m, 31 May 1966 (fl, fr), *H. S. Irwin, J. W. Grear Jr., R. Souza, R. Reis dos Santos 16349* (holotype, NY). Figure 2G–J.

Plants rosulate annuals; roots white, spongy, branched, the larger 0.5–0.7 mm diam. *Leaves* recurved, ± prostrate, ca 1.0–1.2 cm long, 1.0–1.5 mm wide, ligulate, subacute, the tip minutely recurved and keeled; 3- to 5-veined, the midvein visible adaxially as a white line, at least in the basal half; pubescent abaxially with short appressed malpighian hairs, and adaxially with long filamentous arachnoid hairs, both surfaces glabrate. *Inflorescences* numerous, ca. 25 to 50, of mixed ages, sometimes with new inflorescences initiating outside the older ones; peduncle sheaths 10–17 × 0.6–0.8 mm diam., the lamina ca. 2 mm long, acute, callous-tipped, slightly recurved; arachnoid pubescent as the leaves, also with scattered upright gland-tipped hairs; white-costate only near the base; *peduncles* 6–15 cm long, (0.25–)0.3–0.4 mm wide, 3-costate; the intercostae green and arachnoid pubescent, broad near the apex, narrowing to thin furrows below; the costae stramineous, glabrous, shiny, with a few gland-tipped hairs when young; *capitula* 4–5.5 mm diam., ovoid in bud, depressed-hemispheric to globose at maturity; involucral bracts hyaline, glabrous, lustrous, the outer obovate, rounded-apiculate at apex, pale, shredding with age, the inner oblanceolate-obtuse to linear-acute and gold with a brown tint; shorter than the pistillate flowers; receptacle densely white-villous, trichomes about equaling the staminate flowers; receptacular bracts absent. *Flowers* 3-merous, the staminate and pistillate about evenly mixed and strongly dimorphic, the staminate flowers pigmented and much shorter than the pistillate, the pistillate surpassing the involucral bracts by 0.6–0.7 mm, abscising after seed set; *staminate flowers*: pedicels ca. 0.15–0.25 mm; *calyx* coppery brown, zygomorphic, the segments ca. 1.0 × 1.0 mm, broadly obovate-spatulate, rounded, slightly cucullate, fused ca. ½–⅔ of their length, sparingly pubescent to glabrate on the abaxial face; *corolla* borne on stipe ca. 0.5 × 0.1 mm; the corolla itself ca. 0.35 mm long, membranous, the lobes involute; filaments ca. 0.35 mm, adnate to corolla; anthers white, 0.2 mm long; pistillodes ca. 0.25 mm long, infundibular, the rim papillate; *pistillate flowers*: pedicels ca. 0.5 mm long; *sepals* oblong-elliptic, acute to broadly acuminate, navicular and slightly sclerified along midvein at base,

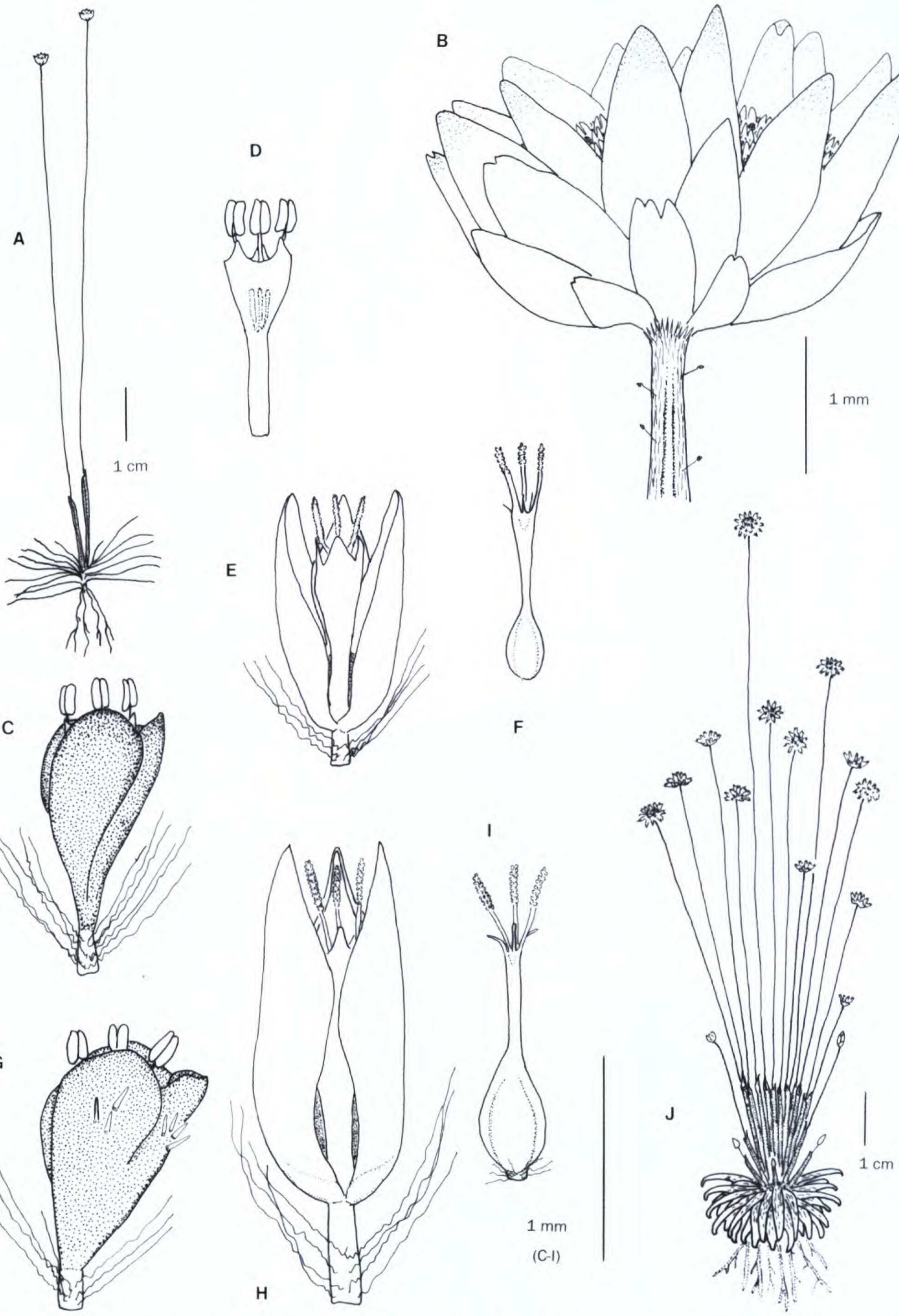

Figure 2. A–F. *Syngonanthus dichroanthus* Hensold. —A. Habit. —B. Capitulum. —C. Staminate flower. —D. Corolla of staminate flower. —E. Pistillate flower. —F. Gynoecium. G–J. *Syngonanthus latifolius* (Mold.) Hensold. —G. Staminate flower. —H. Pistillate flower. —I. Gynoecium. —J. Habit. Vouchers: A–F *Pires & Black 2365*; G–J *Irwin et al. 16349*.

1.7–2.0 × 1.0 mm, white-hyaline, tinged brown at apex, glabrous; *corolla* short-stipitate, the petals fused at middle margins, free at base and apex, linear-oblanceolate, acute to acuminate, involute after anthesis, ca. 1.1–1.3 × 0.25 mm, membranous, glabrous at maturity; style ca. 0.6 mm long, style branches ca. 0.4 mm long, appendages small and filamentous. Seeds red-brown, ca. 0.4 × 0.2 mm, with raised white longitudinal ribs after wetting, the epidermis waxy (under SEM).

Ecology and distribution. Known from a single collection in marshy campo at 550 m, at the margin of gallery forest in cerrado of northeastern Mato Grosso, Brazil, ca. 52°W, 14°S.

Syngonanthus latifolius was originally described as a variety of *S. gracilis* (Bongard) Ruhland, distinguished from other varieties by the leaves wider and more closely appressed to the ground. The marked size and color dimorphism of the flowers were not noted in the original description, however, and together with the leaf characters, support recognition of the taxon as a distinct species.

The closest affinity of *Syngonanthus latifolius* is probably with *S. dichroanthus* Hensold, which has a nearly identical floral structure and color dimorphism, but flowers subequal in size, and membranous filiform leaves. In *S. latifolius*, the sepals and pedicels of the pistillate flowers are nearly twice as long as those of the staminate flowers, such that the small rounded golden-brown staminate flowers are dwarfed by the white acute pistillate flowers with which they are intermixed. Similar differentiation in flower size and a similar aspect to the capitulum are matched only in the species *S. biformis* (N. E. Brown) Gleason, but the latter is distinguished by its uniformly white flowers, pubescent involucres, densely pubescent petals in the pistillate flowers, and prominent style appendages.

Affinity is also suggested with *Syngonanthus gracilis* var. *aureus*, with which *S. latifolius* shares the annual habit, nearly glabrous sepals and petals, reduced filiform style appendages, and the waxy coating observed on the seeds under SEM (Hensold, unpublished data).

Both *Syngonanthus latifolius* and *S. dichroanthus* have been collected together with *S. gracilis* var. *aureus* in wetlands (veredas) associated with cerrado. Eiten (1975) described in detail the abruptly delineated "seasonally marshy grassy campos" or "hillside campos," which separate gallery forests from upland cerrado in the Brazilian Serra do Roncador and elsewhere. Created by rainy season drainage, these campos have gleyed soils, especially in their lower, wetter portions, where Eriocaulaceae are reported as a typical element. *Syngonanthus dichroanthus* may occur on wetter sites than *S. latifolius*, since both the Río Iténez site and the veredão in Maranhão are inundated for longer periods than the valleys of the Serra do Roncador (Eiten, 1975), but more collections are needed to confirm this.

Additional specimen examined. BRAZIL. **Mato Grosso:** Serra do Roncador, gallery margin, ca. 86 km N of Xavantina, 550 m, 31 May 1966, *H. S. Irwin et al. 16346 p.p.* (GH) [mixed sheet with *S. gracilis* var. *aureus* Ruhland, probably from the same gathering as *Irwin et al. 16349*, the type].

Acknowledgments. Many thanks to Greg Mueller and the Botany Department at the Field Museum for providing research space; to Peter Jørgensen, editor of the *Catálogo de las Plantas Vasculares de Bolivia*, for help and encouragement; to Luzmila Arroyo and Mike Nee for crawling specimens at USZ and NY; and to the curators of GH, LL, MO, NY, and P for loans of material.

Literature Cited

Eiten, G. 1975. The vegetation of the Serra do Roncador. Biotropica 7: 112–135.

Giulietti, A. M. 1978. Modificações taxonômicas no gênero *Eriocaulon* L. Bol. Bot. Univ. São Paulo 6: 39–47.

———. 1984. Estudos Taxonômicos no Gênero *Leiothrix* Ruhl. (Eriocaulaceae). Tese de Livre-Docência, Universidade de São Paulo, São Paulo, Brazil.

Killeen, T. J., E. García & S. G. Beck (editors). 1993. Guía de Arboles de Bolivia. Missouri Botanical Garden, St. Louis, and Herbario Nacional de Bolivia, La Paz.

Ruhland, W. 1903. Eriocaulaceae. *In*: A. Engler (editor), Das Pflanzenreich IV. 30: 1–294. Wilhelm Engelmann, Leipzig.

Stützel, T. 1988. Untersuchungen zur Wurzelanatomie der Eriocaulaceen. Flora 180: 223–239.

———. 1998. Eriocaulaceae. Pp. 197–207 *in* K. Kubitzki (editor), The Families and Genera of Vascular Plants, Vol. IV. Flowering Plants. Monocotyledons. Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg.

Tomlinson, P. B. 1969. Anatomy of the Monocotyledons III. Commelinales–Zingiberales. Clarendon Press, Oxford.

Zhang, Z. 1999. Monographie der Gattung *Eriocaulon* in Ostasien. Diss. Bot. 313: i–vii, 1–289.